

Handbook

BEST PRACTICE

DROPPES OBJECT MANAGEMENT

Rev. 03-2012



www.samarbeidforsikkerhet.no

Foreword

Dropped objects (DO) present significant safety challenges. Surveys have shown that these challenges relate to a number of factors, including work processes, behaviour, design, and the insufficient securing of equipment.

As an improvement measure, Working Together for Safety (SfS) decided to issue this handbook, which summarises relevant requirements relating to the securing of tools and fixed and moveable equipment.

The handbook was originally produced by Statoil, in close collaboration with equipment suppliers and users. An SfS working group, with members from both operators and suppliers, has been responsible for the revisions made to this edition. The purpose of the handbook is to disseminate knowledge and best practice to the entire industry – and eliminate dropped objects!

Two fundamental concepts in all HSE work are an understanding of risk and a barrier-based approach. Risk includes both probability and consequences. The probability that a DO will occur can be significantly reduced through good design and the establishment of the barriers described in this handbook. The consequences can also be reduced through good design and planning: Low-weight equipment placed at low heights and away from walkways results in reduced risk through reduced consequences.

SfS would like to thank Statoil for taking the initiative to create this handbook, and encourages everyone to use it actively in order to understand and establish the necessary barriers. We would also like to thank DOM Group AS for their assistance with images and the layout of this edition.

Equipment suppliers in particular are encouraged to continually work to find safer solutions.

Hugo Halvorsen
General Manager, SfS

Innhold

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The purpose of this handbook

This handbook is intended to help eliminate the risk of dropped objects. It applies to equipment that shall be procured, as well as to equipment that is already in use. Best practices have been prepared for the equipment covered in this document, which in many cases set a new standard for our activities. An important goal has been to define barriers that shall prevent dropped objects, and which shall be used in the procurement, use and maintenance of equipment.

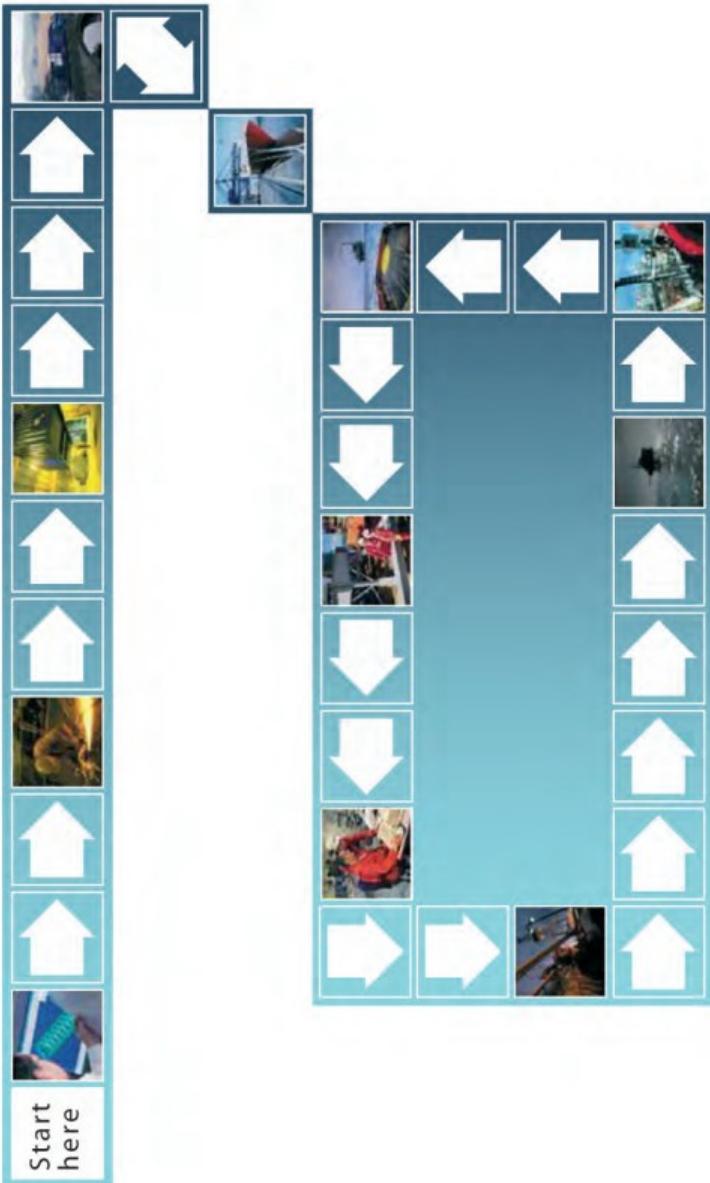
When procuring new equipment, we must endeavour to use integrated solutions/barriers, since this is the basis for eliminating dropped objects. This means that both suppliers and buyers must be aware of this problem.

When installing new equipment, an evaluation of the risks relating to placement must be carried out in order to reduce the danger of collisions/DO. In addition, equipment must be designed to tolerate the environment for which it is intended, and installed to provide the safest possible access for maintenance (ref. NORSOK, PSA, OLF and the Norwegian Labour Inspection Authority).

The best practices described in this handbook must be complied with throughout the entire value chain, from design to removal. By following best practices, we will move towards achieving our overall goal of 0 dropped objects.

For lifting operations, the packing and securing of loads, and the use and inspection of load containers, please refer to OLF guidelines 116 and NORSOK R-003 / R-005.

Who is responsible? Everyone in the value chain! (See next page)



Abbreviations / terms

ABS: American Bureau of Shipping

AD: Arbeidsdepartementet (The Norwegian Ministry of Labour)

AISI: American Iron and Steel Institute

API: American Petroleum Institute, issues production standards for equipment used in the oil industry.

Atil: Arbeidstilsynet (The Norwegian Labour Inspection Authority)

Barrier, primary: A barrier that is established through installing equipment in accordance with a standard procedure or through bolts being installed with sufficient torque/pretension.

Barrier, secondary (secondary retention): A barrier that is established in order to achieve an extra level of safety (e.g. safety wire, the locking of bolt connections in order to avoid loss of torque and pretension), and to protect and secure equipment and personnel.

CCTV: (Closed-circuit television) surveillance camera

Competent person: A person that can document practical and theoretical knowledge within a particular area or discipline.

DIBt: Deutsches Institut für Bautechnik

DnV: Det Norske Veritas

Documentable: Equipment must be labelled in a way that ensures traceability to the producer or importer, and with information including the load, area of application and product standard.

Documented training: Training through which it can be documented that the person who shall use the equipment has received practical and theoretical training that provides knowledge about the equipment's assembly, operation, utilisation and areas of application, as well as maintenance and control in accordance with the requirements that are set for the safe use and operation of the equipment in regulations and user guides.

DO: Dropped object, i.e. the uncontrolled movement of an object from one level to another. It is emphasised that dropped objects do not only occur during work at heights.

DROPS: Dropped Object Prevention Scheme, a global industry initiative that focuses on the prevention of dropped objects (www.dropsonline.org).

EN: European Standards, issued by CEN (The European Committee for Standardisation) and adopted by one of the three recognised European standardisation bodies – CEN, CENELEC or ETSI.

F.E.M: European Federation of Material Handling

HSE: Health, safety and environment

ISO: International Organisation for Standardisation

Lifting equipment: Common term for lifting gear, lifting devices and lifting units, used in combination or individually.

NHD: Nærings- og Handelsdepartementet (The Norwegian Ministry of Trade and Industry)

OLF: Oljeindustriens landsforening (The Norwegian Oil Industry Association)

PSA: The Petroleum Safety Authority

Risk: An expression of the danger that an undesirable incident represents to people, the environment or material assets. The risk expresses the probability of an accident occurring, as well as its consequences.

Risk evaluation: A systematic method of describing and/or calculating the risk to people, the environment and equipment. A risk analysis is carried out through the mapping of undesirable incidents and their causes and consequences.

RNNP: Risikonivå i Norsk Petroleumsvirksomhet (Trends in risk levels in the Norwegian petroleum industry)

SfS: Samarbeid for Sikkerhet (“Working Together for Safety”) is among the most extensive collaborative projects within the field of health, safety and the environment (HSE) within the oil and gas industry.

SWL: Safe working load

TÜV: Technischer Überwachungsverein

Weak Link: A Weak Link is intended to be the weakest connection point between a tool and its user. The user is able to disconnect from the tool with a strong tug should an emergency situation occur. Weak Link 1 kg is designed to withstand a tug of 10 Joules without deformation, Weak Link 2 kg is designed to withstand a tug of 20 Joules without deformation, etc.

Work at height: All work carried out at a height of 2 m or more above a fixed deck. Remember that on a rig installation, work at height can be carried out on all decks. Be aware of vessels and subsea equipment.

WLL: Work load limit

Shall/must and should:

In this handbook, the word “must” or “shall” is used where we believe that authority requirements apply.

The word “should” refers to a best practice. If another solution is selected, an equal or better level of safety must be documented.

Part 1: General information

Chapter 1: The most important areas – where do dropped objects occur?

The PSA's project 'Trends in risk levels in the Norwegian petroleum industry' (RNNP), publishes an annual report which looks at the level of risk within the petroleum industry. One of the surveyed indicators is dropped objects, DFU 21.

During the period 2002-2010, an average of 235 incidents relating to dropped objects were reported to RNNP each year. The number of incidents reported each year has remained relatively stable, with a slight decrease during the last three years, to 146 incidents in 2010. On the Norwegian continental shelf, two deaths and 85 personal injuries relating to dropped objects have occurred since 2002.

According to RNNP, approximately half of all dropped objects incidents that occurred in recent years were related either to 'drilling and wells' or 'cranes and lifting' related work. Of the 873 analysed DO incidents that occurred between 2006-2010, 27% were related to design/technical solutions, 44% to human factors, and the remaining 29% were due to external conditions such as the weather, wind, waves, etc. For more detailed information, please see the annual RNNP report.

These facts clearly show that DO is an area upon which we should maintain continual focus in order to reduce the level of risk within the industry.

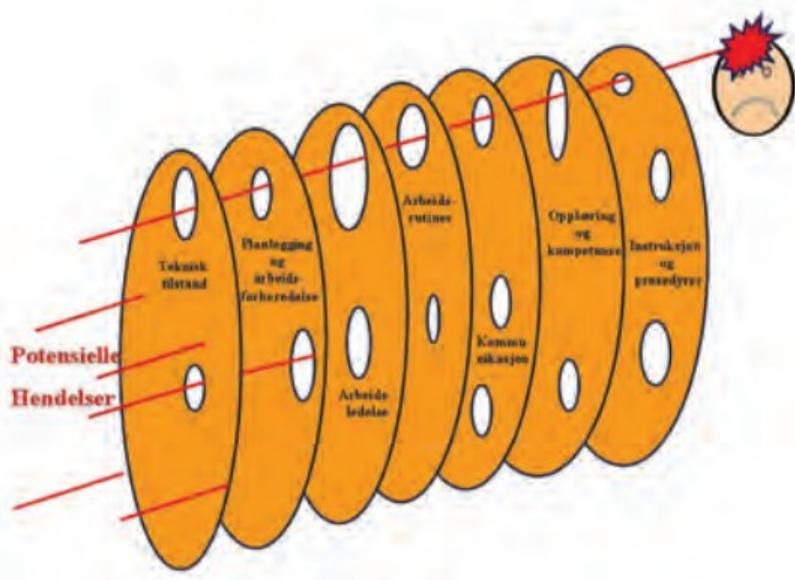
Chapter 2: Barriers

Barriers are functions and measures that shall prevent or reduce the consequences of undesirable incidents.

We have three main types of barriers:

Human, technical and organisational.

Examples of these types of barriers are given below. Common to all barriers is that they shall not obstruct effective work processes, but provide an extra safety net.



HTO

- **Human**

(knowledge, experience, qualities and operational methods)

- **Technical solutions**

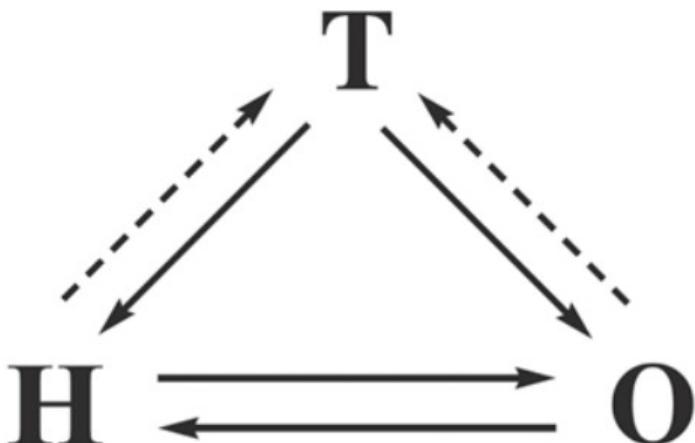
(safety wires, Nord-Lock, cotter pins, tool bags, etc.) alone can serve as barrier functions, but they often need to be combined with organisational and/or human solutions

- **Organisational**

(procedures, specifications, checklists, etc.)

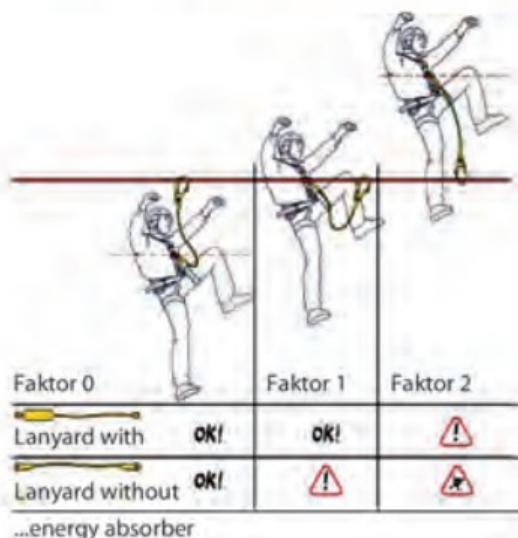
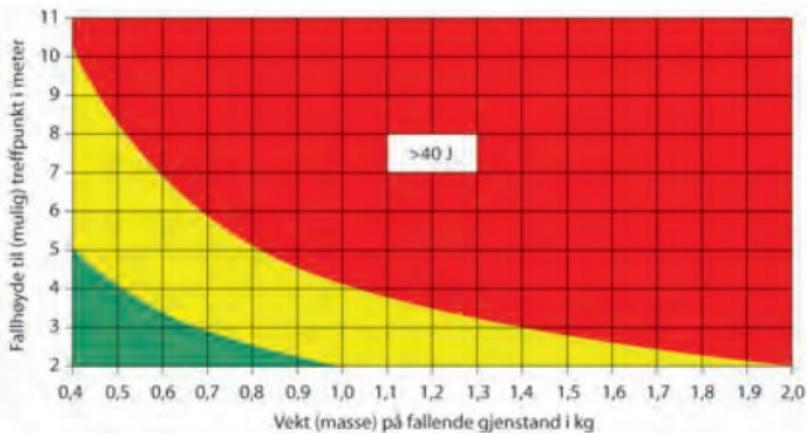
H and O solutions **cannot** fulfil barrier functions alone; they must always be combined with at least one of the other solutions.

This handbook mainly describes technical barriers.



Chapter 3:

Fall energy and fall factors



Fall factors

The “fall factor” describes the severity of a fall. It is an expression of the relationship between the length of the fall and the length of rope available to break the fall.

The fall factor is calculated using the formula on next page

Fall energy

All equipment at height has a potential fall energy, which is dependent upon the equipment’s weight and the height from which it may fall.

Fall energy (Ef) is measured in Joules, and calculated using the formula Ef=mgh, where m = the weight of the object in kg, h = the height from which the object is dropped, and g = the gravitational acceleration (9.81m/s²).

The figure to the left is based on this formula, and can be used to calculate fall energy to estimate the severity of possible injuries.

The potential for injury depends upon a number of factors, including the equipment's fall energy, hardness and shape, where it hits the body, etc.

A fall energy over 40 Joules (red area) may result in serious injury or death.

A fall energy between 20 and 40 Joules (yellow area) may result in the need for medical treatment.

A fall energy between 0 and 20 Joules (green area) may result in the need for first aid, or no injury.

The injury potential must be classified in accordance with these values, and if necessary adjusted with regard to the type of dropped object. Sharp objects with low kinetic energy can have a higher injury potential than a blunt/soft object with a higher kinetic energy.

The limits described above are the norms used in the Norwegian petroleum industry. SfS is aware that other forums, such as DROPS, operate with other limit values.

Fall factor

The fall factor is the length of the fall divided by the length of the securing device that absorbs the fall energy. The force to which a person or object is exposed depends on the energy-absorbing properties of the securing device (ability to lengthen without breaking). Energy absorbers are therefore important, even on securing devices for tools.

When securing persons against falling, the fall factor must preferably be kept below factor 1, and shall under no circumstances exceed factor 2.

Chapter 4:

Routines for work at height

Work operations within the oil industry often involve work at height. Many operations therefore contain an element of risk due to height:

- You are exposed to equipment or work operations above you
- Personnel below you are exposed to your work
- You work at height above a deck

We distinguish between the securing of personnel working at height, the securing of permanent equipment, and the securing of tools and parts that are used at height during a work operation.

Ideally, all work should be carried out on a deck with its ends and openings secured against falls to a lower level. In this situation, the executing worker is secured against falls, and other personnel are protected from dropped objects.

However, many operations must be executed at height. For such operations, approved scaffolding together with secured tools/equipment and access control will provide the desired level of safety. If it is most appropriate to work from ladders, riding belts or climbing equipment, the executing worker must also be actively secured, and a rescue plan must be in place.

Checklist

- Select appropriate equipment
- Only use approved materials (approved scaffolding)
- Do not start work before you have checked that the equipment is in accordance with regulations
- Ensure that access to the area is restricted if necessary
- Use fall protection equipment if necessary (documented theoretical and practical training is a prerequisite)
- Secure equipment and tools

Chapter 5:

Securing tools and equipment during work at height

When using tools at height, the potential for dropped objects is great, and represents a significant risk.



Chapter 5.1: Securing tools <5 kg

Weak link



Snap-coil: Example of energy-absorbing fastening



Tool belt
for scaffolders



AISI 316L snap hook
with 3 barriers in locking
and certification

Securing of tools



Safety wires and connectors



Internal securing loops



Best practice

- All use of tools at height must be risk assessed
- All tools shall be secured against being dropped, both during transport/moving and during work
- Attachment points/devices on tools and bags must be documentable
- Fastenings on tools shall be energy-absorbing (energy absorbers)
- A weak link shall be installed between the body and safety wire when fall arrest devices are used. Weak links for tools weighing over 2 kg should not be used
- Tools heavier than 2 kg should not be secured to the body with wire. If a coiled cord is used, the limit is 3.5 kg
- A tool bag with internal loops should be used when several and/or heavy tools are used at height
- Wrist straps can be used for one tool weighing under 1 kg, with a weak link
- If an attachment point other than the belt or bag is required, use an appropriate part of the surrounding structure, preferably above the work level
- For work on/near rotating machines or moving equipment, tools should normally be secured to the adjacent structure
- Tools used at height should be checked out/in (ref. Tool cabinets for work at height) to ensure that nothing is left behind

Chapter 5.2: Securing tools 5-25 kg



Best practice

- All use of heavy tools and hand-held machinery where equipment may fall to an underlying level must be risk assessed
- All heavy tools and hand-held machinery used at height must be secured against being dropped, both when in use and while being transported
- Only certified lifting equipment shall be used as securing devices
- The attachment points/devices on tools shall be documented
- Fastenings on tools shall be energy-absorbing (energy absorbers)
- Securing points for tools and machinery must be in place above the work site, attached to the surrounding structure, not to scaffolding. The securing device must be as taut as possible
- Tools used at height should be checked out/in (ref. Tool cabinets for work at height) to ensure that nothing is left behind

Chapter 5.3: Securing other portable equipment



Best practice

- All portable equipment used where there is a risk of the equipment falling to an underlying level must be secured against being dropped
- Carrying pouches must always be used for radios and any other portable equipment without certified securing points
- Locks on pouches must have a double securing mechanism to prevent unintentional opening
- Belt clips that allow equipment to become detached when turned 180° should not be used
- Belts with snap fasteners are not suitable for securing equipment at height

Chapter 5.4: Securing equipment and parts



Best practice

- All repairs and maintenance work carried out at height must be risk assessed
- All parts, equipment and materials that are worked with at height must be secured against being dropped
- Smaller parts must be stored in suitable storage boxes, bags, etc.
- In restricted areas, such as the derrick, flare boom and cranes, tools used at height must be logged out and in to ensure that nothing is left behind
- When the work is finished, a final check and inventory count must be carried out to ensure that no tools, equipment or materials are left behind at height

Chapter 5.5: Tool cabinets for work at height



Best practice

- Each cabinet/locker shall be equipped with a list of contents and be kept locked
- A designated person must be responsible for the cabinet to ensure that all tools taken from and returned to the cabinet are logged out/in
- The contents of the tool cabinet for work at height and its accompanying log book must be checked at the end of every shift in which the tools have been used
- All tools must be adequately equipped for securing at height and must have documented attachment points in accordance with Chapter 14: Securing devices
- In addition to the necessary tools, cabinets should be equipped with a sufficient number of:
 - Correctly dimensioned safety wires with approved swage locks
 - Locking connectors/snap hooks
 - Tool bags with internal fastening devices
 - Special belts for fastening of tools and bags
 - Weak links for fastening between the body and safety wire

Chapter 6: Securing personnel

Documented training is a mandatory requirement for all personnel using fall arrests.



Fall strap reel with shock absorber

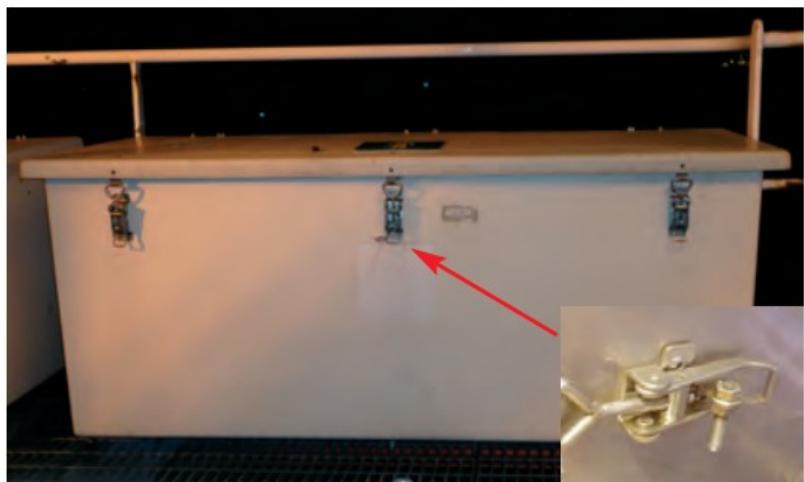
SALA trauma strap



Best practice

- The established control procedures, both before and after use, must be followed
- Nobody shall work alone or unattended when using fall protection equipment
- Personnel who use fall protection equipment must have documented training that includes rescue methods
- Necessary rescue equipment must always be available at the work site
- A buddy check of the rigging and equipment must be carried out
- Fall protection equipment must be CE marked
- The equipment must be checked at least every 12 months by a competent person and shall be labelled with the date for the next inspection
- The type of securing equipment shall be selected following an evaluation of the work site
- The anchor point for suspension shall be able to support at least 10kN (see requirement in NS-EN795)
- The harness should be equipped with a safety strap (e.g. the SALA trauma strap, which allows you to rest on your feet after a fall, in order to ensure blood circulation to the legs)

Chapter 7: Securing tools and equipment against wind and weather conditions



Best practice

- Structures and equipment should be designed so that water cannot collect and form ice
- Establish routines for inspection before, during and after adverse weather conditions, such as strong winds, high waves, and the risk of ice/falling ice
- Use available time during shift changes to carry out an extra check of equipment that may loosen
- Check whether the workplace is clean and tidy. Equipment stored on deck and in other areas may be blown over by the wind, so check the securing devices
- Check windsocks, wind meters, floodlights, antennas, antenna masts and scaffolding
- Carefully check that equipment in the vicinity of the helideck is sufficiently secured
- Check for any loose objects on roofs, load carriers and in all storage areas
- Check that the lids of storage boxes are secured

The Area Responsible has a particular responsibility for orderliness and tidiness in his/her area.

Chapter 8: Unnecessary equipment at height



Best practice

- Regularly carry out a risk assessment and review of what equipment is required at height, and what should be removed
- The review should establish whether equipment should be re-located to reduce the risk of collision with mobile equipment
- Inspection and maintenance procedures should be revised regularly, to ensure inspection and maintenance of all equipment installed at height
- Always carry out a final check to ensure that no equipment or materials are left behind at height

Chapter 9: Post inspection / final check of the work site



Experience shows that a clean and tidy workplace is less exposed to risk than the opposite.

On facilities and installations with rotations and shift work, this effect is intensified by the fact that we are also exposed to other people's "clutter".

It is therefore extremely important that we have good routines for final checks of the work site.

Best practice

- Always keep your work site tidy
- Tools, equipment and materials must be secured in a safe location at the end of each shift
- When the work is finished, a final check and inventory count must be carried out to ensure that no tools, equipment or materials are left behind at height
- Check that all equipment is installed, secured and returned to normal operation
- The work site must be left in a clean and tidy state, and all tools, equipment and materials must be returned to their designated storage place
- Loose objects at height must be removed, attached or secured
- On mobile units, a risk assessment must be carried out to determine whether equipment on work benches shall also be secured

Chapter 10:

Observation technique

Inspection, identification and the categorisation of findings are the first steps in minimising the potential for dropped objects.

Best practice (inspections)

- Set aside ample time
- Limit the size of the area
- Concentrate on a small number of categories and inspect the area in a structured way in order to maintain an overview
- Limit the number of personnel in each area, in order to maintain an overview
- Findings that do not conform to the established standard or checklist should be photographed and given an accurate description and site reference
- Follow-up and the correction of findings are decisive factors in preventing dropped objects

Chapter 11:

Responsibility and follow-up

Best practice

The management's responsibility

- Ensure a high standard of orderliness and cleanliness, undertake random checks – involve the Area Responsible
- Ensure that routines/systems to prevent dropped objects are established:
 - Active use of image-based inspection programme
 - Training in DO observation technique (on the job training)
 - Strengthen daily risk management, identify and manage DO risk
 - Learning and transfer of experience
- Ensure that time and resources are set aside for work with these routines/systems
- Check that the routines/systems are followed/used

Your responsibility

- Follow established routines/systems for the prevention of DO – follow-up your own actions
- Continually identify potential DO risks
- Eliminate dangers to yourself and others
- Report findings or undesirable incidents

Chapter 12: Galvanic corrosion

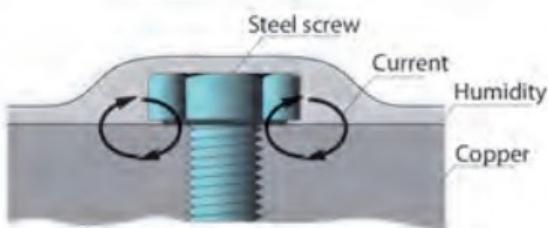
Electrochemical series

Cathode (protected) more noble
Graphite
Titanium
Silver
Acid-proof steel A4 – passive
Stainless steel A2 – passive
Iconel – passive
Nickel – passive
Silver solder
Monel
Copper/nickel alloys
Bronze
Copper
Brass
Tin
Lead
Tin solder
Cast steel
Steel and iron
Aluminium 2024 – T4
Cadmium
Aluminium 1100
Galvanised steel
Zinc
Magnesium alloys
Magnesium
Anode (corrodes) less noble

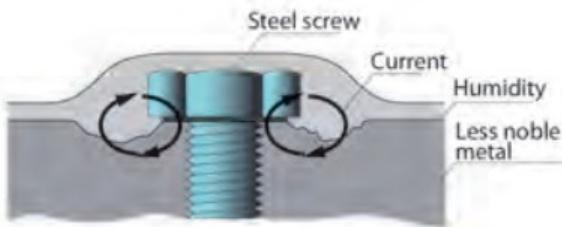
As a general rule, only metals of the same or almost the same nobility should be combined in a corrosive environment.

Galvanic corrosion occurs when two dissimilar metals with different voltage potentials come into contact with each other in the presence of an electrolyte (damp film or seawater/fresh water). When this happens, the less noble metal becomes the anode and the more noble metal becomes the cathode.

If a steel screw is fixed to a copper plate, the screw will be the anode since copper is the more noble metal. The screw will corrode rapidly as the difference in potential is great.



If the same steel screw is fixed to a less noble plate, e.g. a zinc plate, the screw will be the cathode, and will therefore not rust. The zinc plate will corrode, as it is less noble than the screw.



For these reasons, it is important that all securing devices are of the stainless steel type. This applies to cotter pins, safety pins, securing wire, and locking wire for threading through nuts and bolts, etc.

Part 2: Securing fixed equipment



Chapter 13:

Bolted connections

Bolts are currently produced to at least 85 different industrial standards, and the requirements for bolted connections vary for the different sectors depending on the given design and requirements for operation and maintenance.

Achieving a stable bolted connection therefore requires a qualified evaluation of the following factors:

- Load design
- Choice of materials with respect to mechanical properties and corrosion resistance
- The use of lubricant, where appropriate
- Pre-tensioning and use of the correct torque equipment

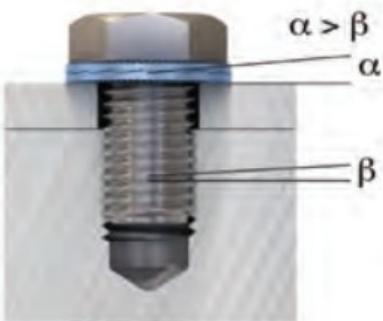
The locking of bolts in order to secure against loss of torque and pre-tension is defined as secondary retention.

Reasons why so many bolts and bolted connections fail:

- | | |
|---|-------|
| • Improper use, installation and handling of the bolt | (30%) |
| • Vibrations | (20%) |
| • Knocks | (12%) |
| • Loads (beyond design) | (11%) |
| • Wear | (6%) |
| • Corrosion | (5%) |

Source: PSA, 2008

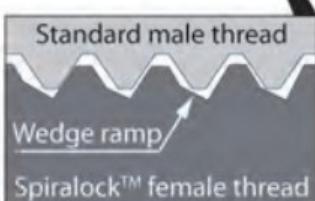
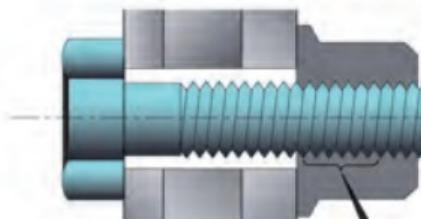
Several independent tests show that double nuts and so-called counter nuts are not a reliable method for securing screws/bolted connections. Below are some recommended methods.



Nord-Lock bolt securing system



Spiralock



Chapter 13.1: **Nord-Lock bolt securing system**

Nord-Lock secures the bolted connection using tension instead of friction. The system consists of a pair of washers that fit together, with cams on one side and radial teeth on the other. Since the cam angle ' α ' is larger than the thread pitch ' β ', a wedge effect is created by the cams, and this prevents the bolt from rotating.

Nord-Lock's locking washers are certified by several independent institutes, such as ABS, DIBt, DnV and TÜV.

Each pair of washers has a unique control number, which ensures full traceability right down to the first installation.

Areas of use:

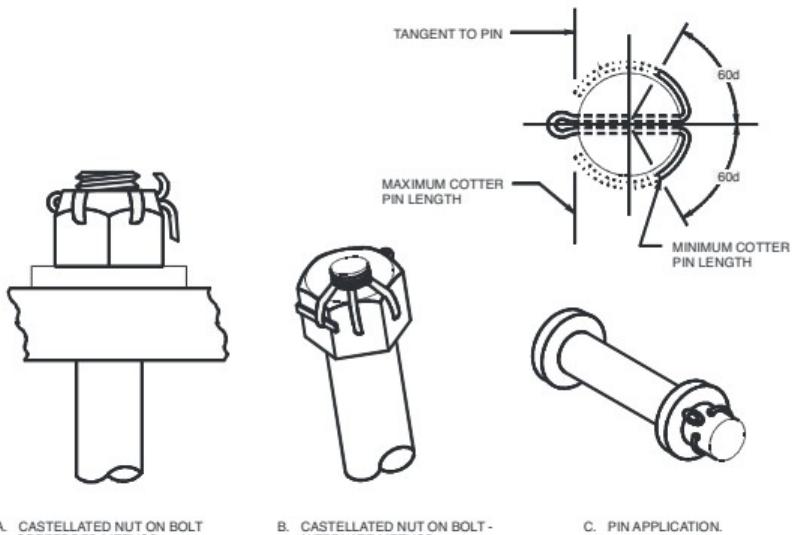
Almost unlimited, but particularly suitable for connections exposed to vibrations or other dynamic loads. Nord-Lock's washers are available in dimensions from 3 mm up to 130 mm in various materials.

Chapter 13.2: **Spiralock**

Spiralock is an all-metal lock nut/bolt with a specially designed threaded profile that locks when tightened and distributes the tension across the entire length of the thread. This provides better load distribution, which helps to improve the locking of the bolt connection.

Areas of use:

Most often used in cable tray systems, but can also be used in other installations.



A. CASTELLATED NUT ON BOLT
PREFERRED METHOD.

B. CASTELLATED NUT ON BOLT -
ALTERNATE METHOD.

C. PIN APPLICATION.

00111348

Correct installation
of cotter pins in bolts



Nyloc lock nuts

Chapter 13.3: **Castle nuts with cotter pins**

Adopted from the aviation industry, castle nuts provide a visual and reliable method of locking bolted connections. The nut has radial slots and is locked by non-corrosive cotter pins that are inserted through a hole in the bolt.

Areas of use:

Unlimited, but frequently used for critical bolted connections.

Chapter 13.4: **Nyloc lock nuts**

Nyloc lock nuts are used extensively throughout the industry. Nyloc lock nuts should only be used once. Standard Nyloc nuts have a temperature rating from -70°C to $+120^{\circ}\text{C}$.

Areas of use:

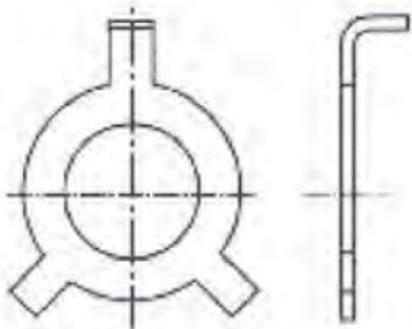
This type of nut is often used for locking in connections where a certain degree of lost pre-tension can be accepted.



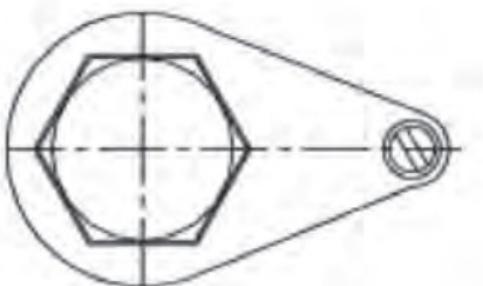
Lock nut
with split top



Lock nut
with deformed top



Tab washer



Tab washer

Chapter 13.5: All-metal lock nuts

All-metal lock nuts can be used on all bolt dimensions. The nut locks by the threaded section or top of the nut deforming/splitting, or through the nut having a toothed ring under the collar. This provides greater friction between the bolt/underlay and nut, providing a secure connection. There are many varieties and suppliers on the market.

Areas of use:

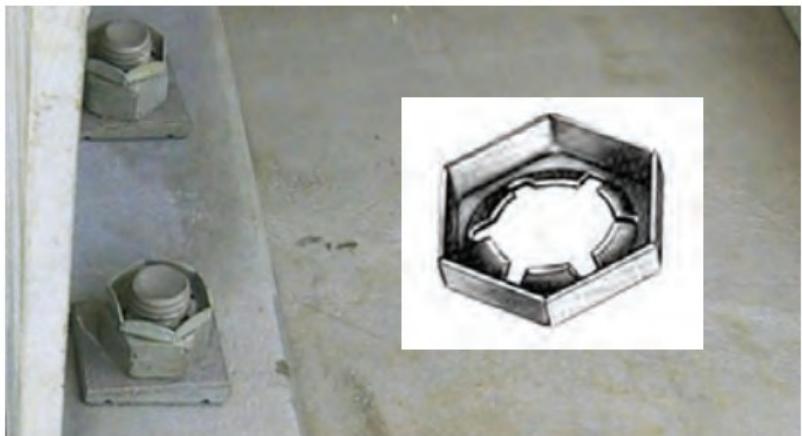
These nuts have an almost unlimited application.

Chapter 13.6: Tab washers / Tab plates

Tab washers can be used on all dimensions and in any application where the use of tab washers is appropriate. There are several types with different areas of application for locking either nuts or bolts. It is important to use the correct type for each purpose.

Areas of use:

Typically used on machinery where it is important to prevent the bolt from rotating.



PALNUT DIN 7967 Lock nut



Lock-wiring bolts

Chapter 13.7: Palnut

Palnut lock nuts have been on the market for several decades as an alternative for locking bolted connections. The Palnut locks by “cutting” itself into the threads on the bolt when it is tightened. In an offshore context, Palnut lock nuts are usually used for locking above standard nuts.

Areas of use:

On through-bolts in fixed equipment and drilling equipment. Easy to install where secondary retention is not in place.

Chapter 13.8: Lock-wiring

The lock-wiring of bolts is a locking method adopted from the aviation industry. In brief, the method involves threading a special stainless wire through a hole in the bolt head, which is twisted and locked to the next bolt or structure, thus preventing the bolt from rotating and loosening. The wire can be used to lock a maximum of three bolts in a row, as shown in the illustration (for information about the size of the hole in the bolt head, see EN-ISO 7378).

Areas of use:

Used extensively for locking external bolted connections on drilling and pipe-handling equipment. Often used where there are no through-bolts and/or it is necessary to be able to easily check the locking visually.

Chapter 13.9: Special bolts

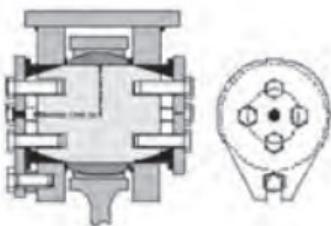
BONDURA BOLT

Bondura bolts have a construction that can take up movement and ovality through the use of expanding tapered sleeves at both ends of the bolt. There are several variants of the bolt, including straight-through versions and others that are fitted from one side. Standard screws are tightened to press in the cones. The bolt is fixed directly to the machine or equipment with locking screws. This prevents the bolt from loosening, falling out or rotating in the bolt hole.

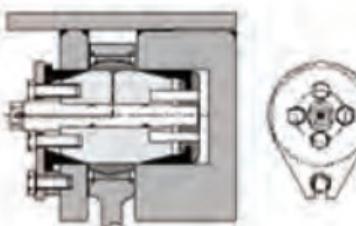
Bondura bolts must be fitted and maintained in accordance with the manufacturer's specifications. Bondura bolts are certified in accordance with API 8C and F.E.M. regulations.

Areas of use:

For example, as a replacement for clevis bolts in top drives, and hinge bolts on dollies, pipe handling equipment and cranes.



Bondura bolt 6.1



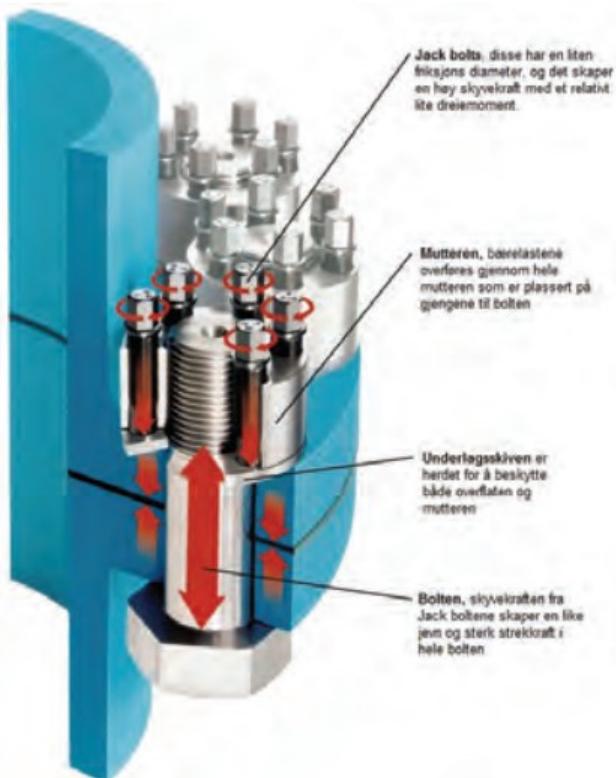
Bondura bolt 6.6

SUPERBOLT® Multi-Jackbolt Tensioners MJT

The SUPERBOLT ® MJT is supplied as a nut or bolt that replaces conventional bolting elements.

They are simple and safe to use, as only hand tools are necessary for installation and removal. The use of heavy tightening equipment or a sledgehammer is therefore eliminated.

SUPERBOLT ® MJTs are available in a corrosion-resistant offshore version, or can be specially designed for specific applications. SUPERBOLTS are available in both metric and imperial threads in all dimensions.

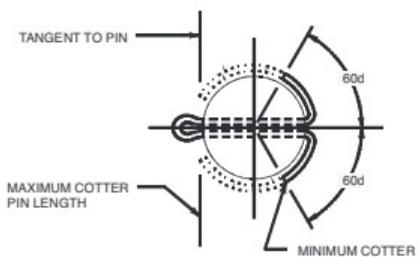


Chapter 14: Securing devices

Wherever possible, equipment installed at height shall feature integrated secondary retention. If this is not possible, or where the risk of DO has been identified, the equipment must be equipped with secondary retention that is securely attached to the structure.



Cotter pin in a shacklebolt



Correct installation of
cotter pins in bolts

Chapter 14.1: **Correct use of cotter pins**

Best practice

- Cotter pins must be bent to prevent them from being knocked out
- Where there is a danger that personnel will be exposed to the pin, the cotter pin must be bent as shown in the illustration
- When hoisting persons and loads, always use shackles with two barriers – a nut and cotter pin
- Linchpins, spring type split pins or any other type of safety pins that can be knocked out must not be used for lifting operations
- Cotter pins should be made of stainless steel
- It is a requirement that cotter pins are inspected regularly and replaced when necessary

Chapter 14.2: Securing pins / safety pins



Best practice

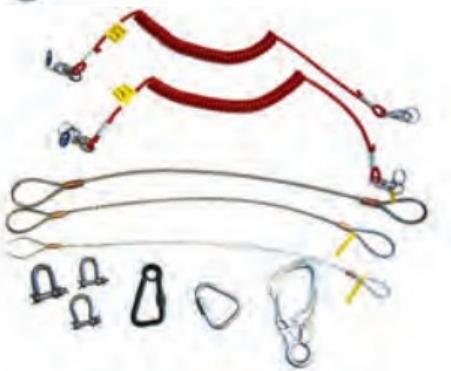
- NB! Securing pins of the type shown in the images must never be used in lifting appliances
- Securing pins shall provide secondary retention
- Securing pins shall be of the proper size and quality
- Securing pins shall be secured by wire (where this is appropriate) to prevent dropping during installation
- It is a requirement that securing pins are inspected regularly and replaced when necessary

Areas of use:

Scaffolding bolts, security bolts on removable railings, claw couplings and securing brackets on gas cylinder racks, etc.

The pin in the top image is usually used in the diving and subsea industry

Chapter 14.3: Wire, chains and couplings



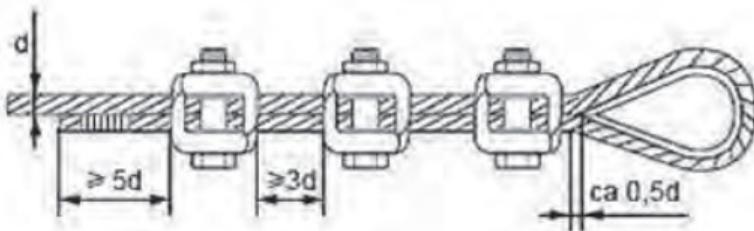
Best practice

- Securing devices must be dimensioned in accordance with the equipment supplier's calculations. The quality of materials used must be consistent throughout the entire assembly
- Only acid-proof securing wire (AISI 316, type 7x19 IWRC) shall be used
- All connectors/snap hooks must be made of acid proof steel (AISI 316) and be equipped with locks
- Snap hooks attached to shackles should have eyelets
- Chain must be made of acid-proof (AISI 316) or galvanized steel, and have short links
- Shackles for use with securing devices should have nuts and cotter pins
- The length of the chain or securing wire must be as short as possible to minimise the potential fall energy
- Securing devices must be installed, maintained and inspected in accordance with the instructions provided in the supplier's user manual or maintenance instructions

All securing devices and all attachments to tools and equipment shall be documented and have traceability information. As a minimum this shall include batch marking, the name of the manufacturer/importer, production year, and information about the maximum load/WLL.

In addition, information about the material type, product standard and an installation/maintenance guide must be available.

Chapter 14.4: Correct installation of wire clamps



Correct installation of Iron Grip wire clamps.

Wire rope Ø mm	Minimum number of wire clamps no.
3-9	3
10-16	4

Best practice

- Wire clamps must be of the correct number and sized to the dimension of the wire
- It is a requirement that wire clamps are assembled, inspected and maintained in accordance with the manufacturer's user manual or maintenance instructions

Note:

Wire clamps of the U-bolt type must not be used in connection with lifting operations

Chapter 15: Structure



Chapter 15.1: Grating

Best practice

- Grating must be adequately fixed to underlying structures to prevent loosening due to vibrations or loads
- Grating should be secured against major sideways displacement in all directions
- Through-bolts or threaded connections with lock nuts are recommended for securing items to the structure
- Openings in the grating must not exceed 20 mm where personnel may traffic the area below, and should otherwise not exceed 35 mm

Chapter 15.2: Piping and equipment feedthroughs



Best practice

- All piping and equipment feedthroughs in decks and grating must have a toe board and must be covered to the greatest extent possible
- Canvas or a cladding material can be used
- Covering is especially important in areas where there is equipment requiring periodic maintenance. If done properly, and preferably permanently, this is an effective measure against dropped objects

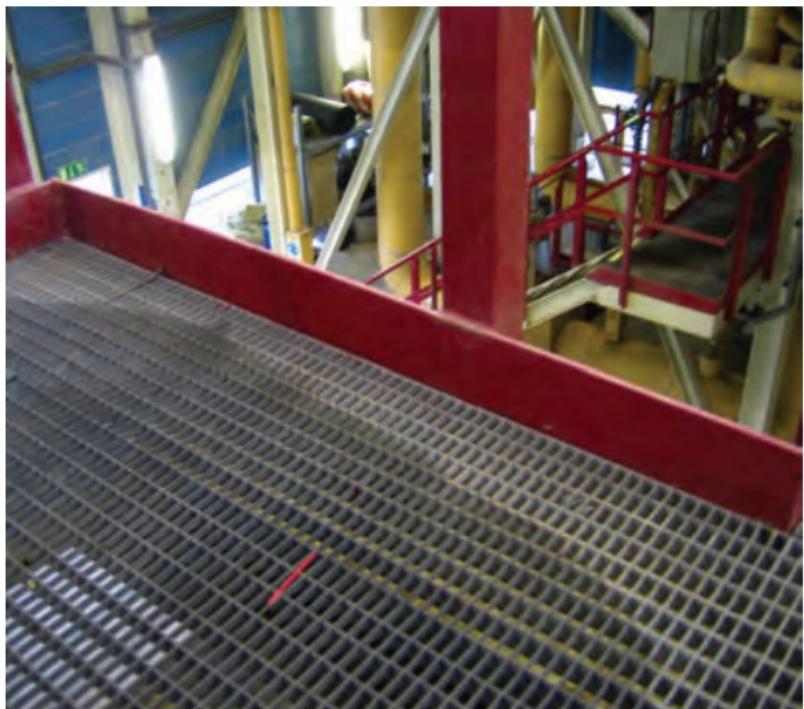
Chapter 15.3: Railings



Best practice

- Railings must be a minimum of 1,100 mm high and have integrated toe boards that are at least 100 mm high
- Railings must be functionally designed for the area they are intended to secure, e.g. wire mesh must be installed as required (loading areas)
- Railings shall not have deformations or cracks that affect their functionality or strength
- It must always be possible to insert movable railings into the fastenings and insert a securing through-bolt
- The safety bolt must be adequately locked using a securing pin, snap hook (with eyelet) or a cotter pin (see also the section on securing pins)
- Both the safety bolt and locking mechanism must be secured in the immediate vicinity of the fastening
- All connections between elements in the railing must be secured with a through-bolt and lock nut
- The use of setscrews is not recommended in permanent railings
- Railings and attachment points for collapsible and movable railings must be inspected on a regular basis to maintain adequate security and functionality

Chapter 15.4: Toe boards



Best practice

- Decks, gangways and platforms must have toe boards with a minimum height of 100 mm
- On stairways, every step must have a toe board with a minimum height of 50 mm
- All landings in stairways must have toe boards with a minimum height of 100 mm
- The gap between the deck or grating and toe board must not exceed 10 mm

Chapter 15.5: Swing gates



Best practice

- Gates must be of the same strength as the surrounding railings
- Gates must be secured in order to prevent disengaging
- Gates must open/swing towards the platform or deck
- Gates must be designed to automatically return to and remain in a closed position (self-closing gates)
- On floating rigs/installations it is recommended that a latch is fitted to secure the gate in the closed position
- Toe boards must be integrated with gates in accordance with requirements
- Wherever possible, the hinges should be an integral part of the gate
- Swing gates must be inspected and maintained on a regular basis to ensure adequate functionality

Chapter 15.6: Ladders



Best practice

- Ladders higher than 9 m must feature an incorporated rest platform every sixth metre, or be equipped with a permanent fall arrest device
- Ladders higher than 6 m should have a rest platform in accordance with recommendations from the Norwegian Labour Inspection Authority
- Safety cages must be installed on ladders of over 3 m, and on shorter ladders where there is a risk of falling to a lower level
- The safety cage must start at a maximum of 2200 – 2300 mm above the deck/floor. The distance between the upper part of the railing and the lower part of the cage should be minimised by using extra protection as appropriate wherever there is a risk of falling to a lower level
- The safety cage must extend to at least 110 cm above the top level
- The diameter of the safety cage must be at least 70-80 cm
- Any damage or deformation must be reported and corrected as soon as possible
- Ladders and safety cages must be inspected on a regular basis in order to ensure adequate functionality

Chapter 15.7: **Wind walls**



Best practice

- Wind wall panels must be fastened to a dedicated support structure and never to the main structure
- Wind wall panels must always be reinforced using horizontal steel beams in accordance with the design loads
- Areas that are exposed to collision risk must have stronger corner mountings secured by through-bolts and lock nuts
- The preferred attachment solution is through-bolts with large washers and lock nuts
- The user manual/instructions must also provide guidelines for the correct installation of joints and attachment points
- Routines for necessary maintenance and the inspection of wind wall panels and their attachment points must be prepared

Chapter 16: Electrical equipment and instruments

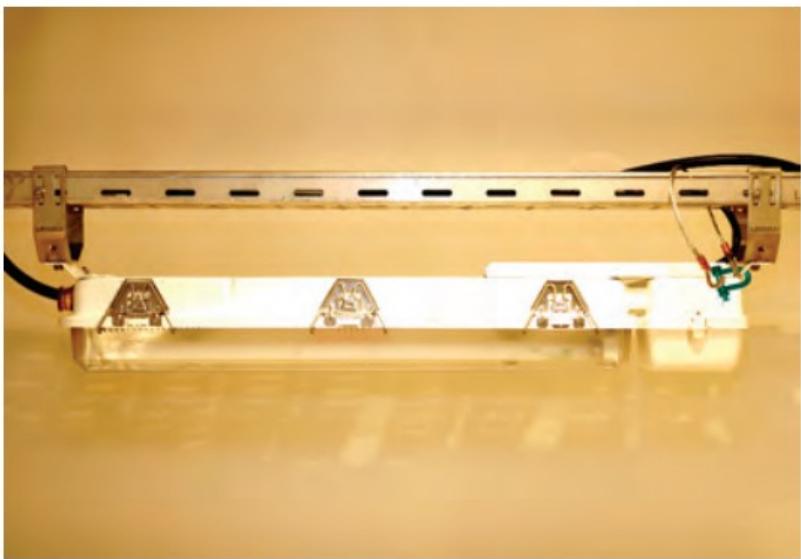


Chapter 16.1: **Floodlights**

Best practice

- Floodlights must be positioned to prevent being hit by equipment/loads
- If there is a risk that the floodlights may be hit by mobile equipment/loads, they must either be protected with reinforced cages or be fitted with safety wires/chains
- Floodlights must be equipped with two independent barriers. The attachment points for wire or chains should be integrated, for example with eye bolts threaded into the floodlight housing
- Calculations relating to the relevant fall energies must be available for attachment points and securing devices
- Fastening devices for securing equipment to brackets or structures should be fitted with secondary retention
- Hatches/screens for the replacement of light bulbs must be hinged or secured with wire to the floodlight housing/frame
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

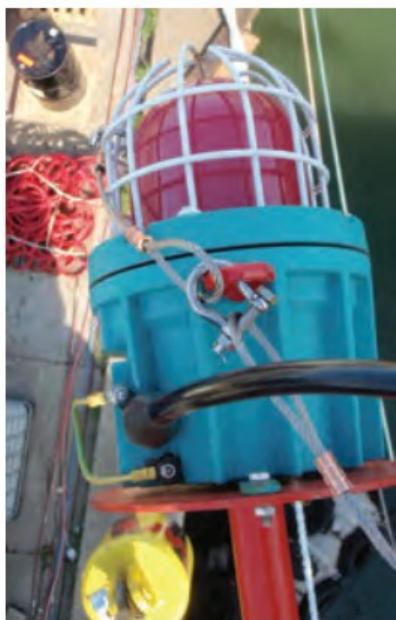
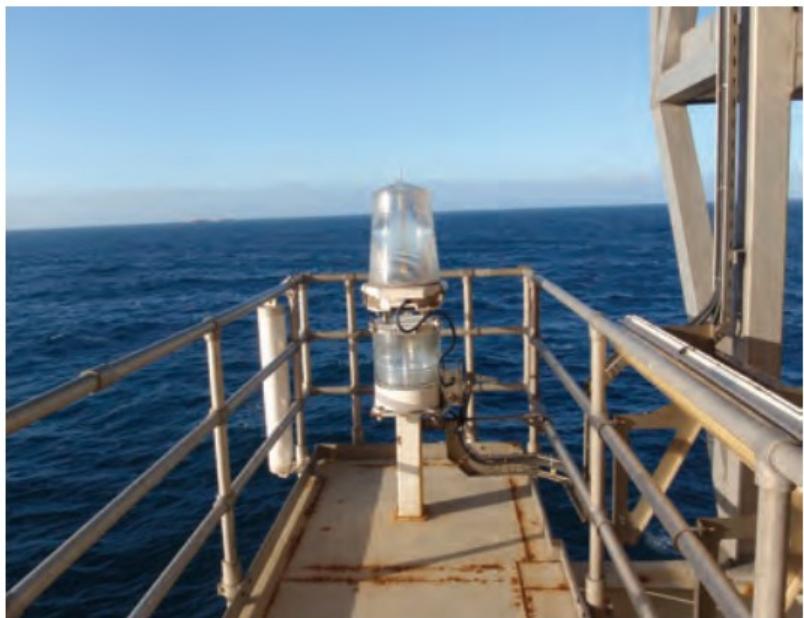
Chapter 16.2: Lighting fixtures



Best practice

- Lighting fixtures must be positioned to prevent them being hit by mobile equipment/loads
- Lighting fixtures and brackets should be fitted with secondary retention
- Attachment points for safety wires should be integrated at both ends of the fixture
- Battery packs must be fitted with secondary retention
- Above walkways and other trafficked areas, fixtures to which power is supplied from one side only should be secured at the opposite end with a safety wire
- The cover should have steel hinges that can be attached on either side
- Plastic components should be avoided, since over time they are weakened by UV radiation
- On existing, older types of fixtures, covers should be secured using stainless steel strips or stainless perforated strips
- The component rail should be hinged and must be able to be properly secured in the closed position
- The strength of attachment points and securing devices should be evaluated in relation to the relevant fall energies
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

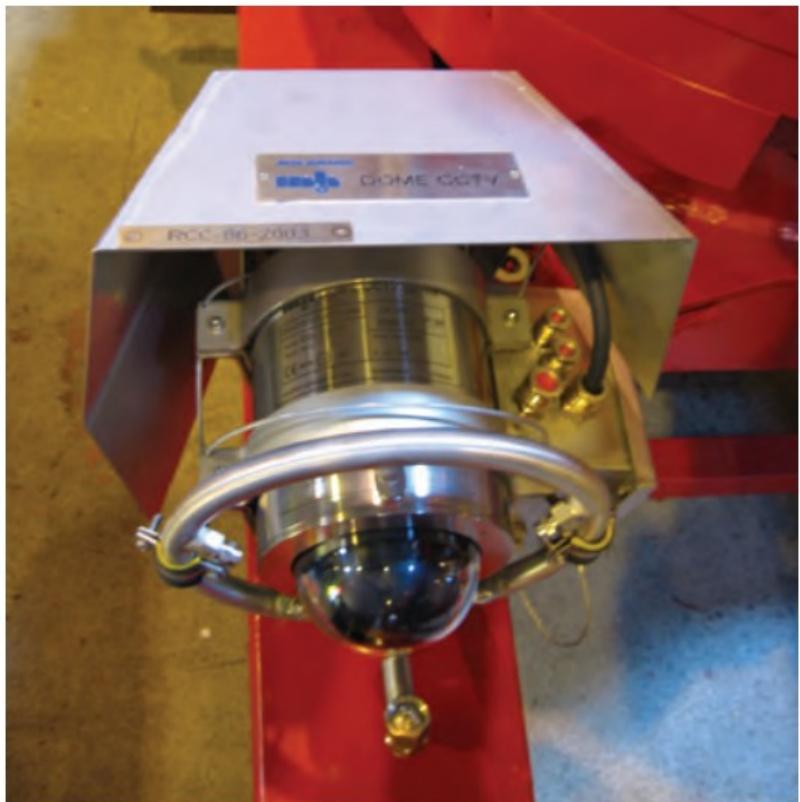
Chapter 16.3: Navigation lights / lanterns



Best practice

- Navigation lights and lanterns should be placed outside areas with normal activity
- The bolts used to attach navigation lights to brackets and structures should be equipped with secondary retention
- Covers for electrical connections must be hinged or secured with wire
- The strength of attachment points and securing devices must be evaluated in relation to the relevant fall energies
- Navigation lights with sliding grooves for bolt attachment to the structure are not recommended
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

Chapter 16.4: CCTV cameras



Best practice (solution with integrated securing device)

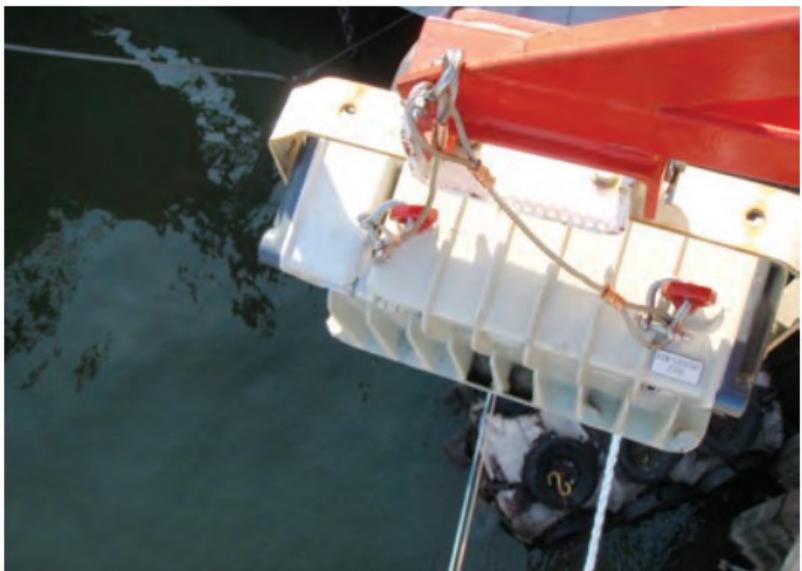
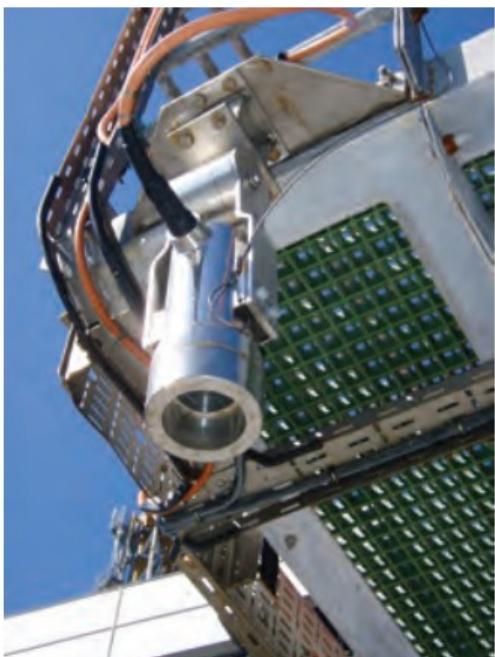
- CCTV cameras should be positioned where they will not be at risk of being hit by moving equipment/loads
- In areas where there is a risk of the camera being hit by moving equipment/loads, the camera shall be shielded by a protective cage
- The camera casing must be fastened to the bracket and structure with adequately locked attachment bolts
- The attachment point for securing devices should be an integrated part of the camera casing and bracket
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available



Best practice (solution without integrated securing device)

- CCTV cameras must be positioned where they will not be at risk of being hit by moving equipment/loads
- In areas where there is a risk of the camera being hit by moving equipment/loads, it must either be protected by a reinforced cage or be attached to the structure with safety wire
- The camera should be fitted with two independent barriers on the camera casing, the motorized pan-tilt-zoom unit, the wiper motor and the lens cover
- The camera casing and motorised pan-tilt-zoom unit should be attached to the bracket and structure with adequately locked attachment bolts
- The attachment point for the securing devices should be integrated into the camera parts. Alternatively, special clamps can be used as attachment points
- Calculations relating to the relevant fall energies should be available for attachment points and securing devices
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

Chapter 16.5: Crane boom camera and floodlight



Best practice

- Crane boom cameras and floodlights must have two independent barriers
- Bolts used for attaching the crane boom camera/floodlight to brackets and structures must be fitted with secondary retention
- Attachment points for the safety wire shall be an integrated part of the camera/floodlight casing. Alternatively, special clamps can be fitted around the camera casing
- The safety wire must run from the camera casing through the camera bracket and then through the attachment bracket before being securely attached to the crane boom structure.
On floodlights, the glass frame must be hinged or secured in another way
- Calculations relating to the relevant fall energies should be available for attachment points and securing devices
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

The crane boom camera and floodlight, securing devices and attachments should be regularly inspected in order to uncover any errors or omissions. The hanger bolt and attachment brackets must also be included in the inspection routines.

Chapter 16.6: Loudspeakers



Best practice

- The loudspeaker's location must be evaluated to prevent risk of the speaker being hit by moving equipment/loads
- If there is a risk of the loudspeaker being hit by moving equipment/loads, it must either be protected by reinforced braces or fitted with a safety wire
- Bolts used to fasten loudspeakers to brackets and the structure should be fitted with secondary retention. As an alternative, a safety wire can be attached between the bracket and structure
- The strength of the attachment points and securing devices should be evaluated in relation to the relevant fall energies
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

Chapter 16.7: Junction boxes and cabinets



Best practice

- Junction boxes and cabinets must be located where they do not obstruct passageways, evacuation routes or moving equipment
- The type and design of attachment and safety devices must be in accordance with calculated loads and known potential external stress factors
- Fastening devices for securing equipment to the bracket or structure shall be fitted with secondary retention
- Where there is danger of the equipment being struck by moving equipment/loads, it must be protected by a reinforced cage or be fitted with a safety wire
- Covers must be secured with wire or chain
- Hinged hatches/doors should be secured against unintentional unhooking, and locking devices should be fitted with barrier against opening
- As a minimum, the manufacturer's instructions for installation and maintenance (user manual) must be followed

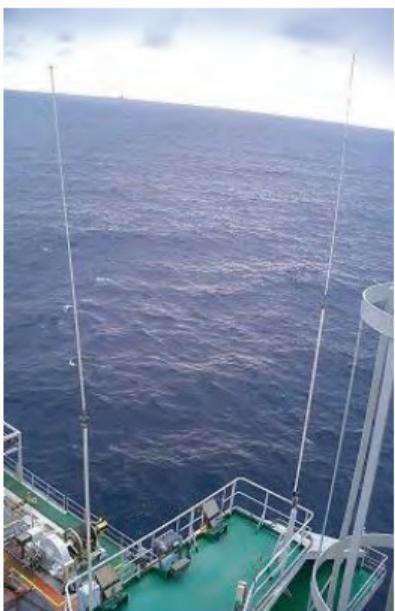
Chapter 16.8: Cable trays and cable ladders



Best practice

- Only approved bolt connections shall be used for fastening and couplings
- Cable fixing clamps with screw connections are used for safe and functional securing of instrument cables
- When attaching the cable support system to a structure, the risk of galvanic corrosion must be assessed and insulation considered where appropriate
- The user manual/instructions for use must also provide guidelines for correct installation, in terms of both the joints and attachments
- In addition, the user manual/instructions for use must provide guidelines for necessary maintenance/re-tightening and the inspection of both electro-steel and bolt and screw connections

Chapter 16.9: Antennas, windsocks and sensors



Best practice

- All fasteners and fastening bows shall be secured against loosening
- Two fastening bows or a minimum of three fasteners shall be always be used
- All bolts shall be through-bolts – do not use set screws
- All heavy antennas should be installed with secondary retention, such as wire or chain
- Stay ropes can be used for stability in accordance with the supplier's specifications. All fasteners must be secured
- Avoid long whip antennas if possible, tensile antennas can be used as an alternative
- Wind sensors with moving parts should be replaced with ultrasonic wind sensors
- Fibreglass whip antennas should be replaced every five years
- All equipment and securing devices shall have routines for preventative maintenance which include the supplier's recommendations and best practices

Chapter 17: Other equipment

Chapter 17.1: Valve handles and valve wheels



Best practice

- Valve wheels and handles must be fitted with secondary retention
- Where possible, nuts and cotter pins should be used in the valve stem on stationary valve handles and wheels (Nord-Lock and Nyloc nuts can also be used where appropriate)
- On large handles and wheels, bolts and lock nuts should be used instead of cotter pins
- When moveable handles or wheels are used, they should be secured
- When not in use, handles and wheels should be stored in an appropriate, safe location
- If Seeger rings are used for locking/securing, frequent inspections/maintenance should be carried out to check for corrosion and/or mechanical damage
- On wheels that are secured by a set screw only, replace the set screw with a through-bolt and lock nut
- Safety wire with a lockable snap hook may be an alternative if the securing methods mentioned above cannot be used

Chapter 17.2: Chain-operated valves

Chain-operated valves without adequate secondary retention can represent a great risk to the operator of the valve.

This is because these valves are often located at height, or in areas that are difficult to access.

There are several different types and designs of chain-operated valves available on the market, but the principles for securing these valves will be the same in most cases.



Best practice

- The valve wheel shall be attached to the valve stem with locked through-bolt connections, e.g. Nyloc nuts and castle nuts with cotter pins
- In cases where the chainwheel is installed on an existing valve wheel, the chainwheel must be fixed to the valve wheel with u-clamps fitted with secondary retention, e.g. Nyloc lock nuts
- If the chain guides are installed with a surface lock ring with clamping sleeves, the clamping sleeves should be replaced with bolts and lock nuts where possible. For chain guides designed with separate clamps, locked through-bolt connections must be used on the clamps
- The valve shall be secured to the structure using correctly dimensioned safety wire and lockable connectors. In many cases it will be appropriate to attach the safety wire to the chain guide on the chainwheel so that functionality is ensured (this presumes that the guide is sufficiently dimensioned and installed using locked bolted connections)
- If it is not possible to attach the safety wire to the structure via the chain guides or another method without functionality being impaired, a swivel device for the attachment of securing devices must be installed. This should only be done by qualified personnel with experience of securing such equipment at height
- For new installations, or when installing securing devices on existing equipment, an up-to-date user manual/maintenance instructions should be available

Chapter 17.3: Locks on insulation cladding



Best practice

- Insulation cladding must be securely fastened to prevent locks from loosening unintentionally
- The locks shall be secured with secondary retention, either by using a bolt and lock nut or by inserting a stainless cotter pin through the securing holes in the locks, or similar
- Maintenance routines must include inspection of the cladding to ensure that it remains in good condition at all times

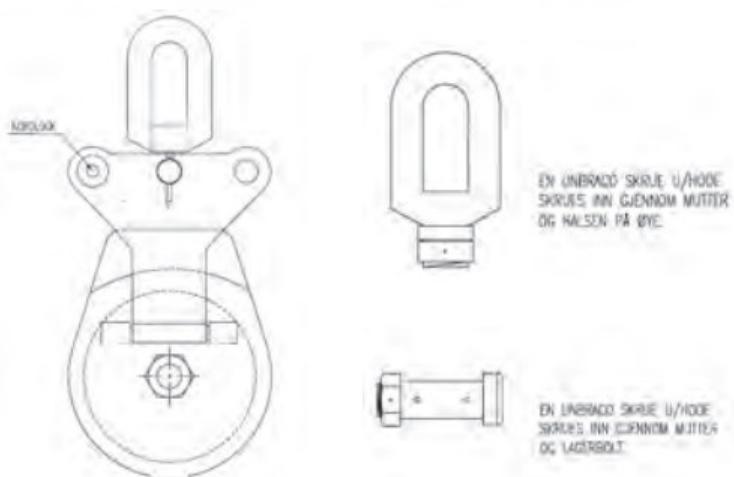
Chapter 17.4: Storage and placement of gas cylinders



Best practice

- All storing/placement of gas cylinders must be risk assessed
- Gas cylinders must be stored, positioned and secured safely
- Temporarily stored gas cylinders must be secured with chain or wire
- Permanent storage racks must be equipped with securing brackets
- The storing of gas cylinders must not obstruct the passage of personnel

Chapter 17.5: Snatch blocks



Best practice

- Blocks must have two barriers in both the suspension and the shaft
- A maintenance program must be established in accordance with the user manual. It is a requirement that blocks, shackles and lifting lugs must be inspected every twelve months by a competent person. This must be documented
- Blocks must be dismantled at the request of the competent person or in accordance with the manufacturer's recommendations, and at least every five years
- Snatch blocks and suspension shackles should preferably be marked with coloured tie wraps of the designated colour code for the year

Chapter 17.6: Umbilical roller sheaves (Banana sheaves)



Best practice

- An umbilical roller sheave must have a maintenance program and be subjected to testing and inspection every twelve months in accordance with the manufacturer's instructions
- Rollers must be secured with two independent barriers, e.g. through-bolts with lock nuts or cotter pins
- An umbilical roller sheave must be used exclusively for the purpose for which it was intended, i.e. it is not permitted to use an umbilical roller sheave to suspend wires
- The umbilical must be installed on deck and the support rollers reinstalled and secured
- A user manual/maintenance instructions for the equipment must be available. The instructions must also cover the installation and maintenance of securing devices
- Sheaves and suspension devices should preferably be marked with coloured tie wraps of the designated colour code for the year

Chapter 17.7: Loop hoses



Best practice

- The equipment manufacturer's instructions for installation and the technical description must be followed
- Clamps must be attached and securely fastened at the point where the hose is labelled "Attach safety clamp here"
- Safety chains must be as short as possible and installed as close to the vertical as possible in order to prevent fall energy and pendulum effect
- Securing devices for hoses must be designed to support the maximum loads generated by a burst hose
- The required resistance to wear and tear, chemicals, heat and UV radiation must also be documented
- The securing system for hoses must be certified and traceable
- The securing devices should be checked and labelled in accordance with the norm for lifting appliances
- In addition to correct instructions for installation, the user manual/maintenance instructions should contain guidelines for necessary maintenance and inspection of the securing devices
- The use of articulated connectors in securing devices should be avoided, since these do not offer appropriate static securing or corrosion resistance.

Chapter 17.8: Signs



Best practice

- Signs, brackets and frames for signs must always be securely attached. The frames should be made of metal.
- Where the underlying material permits, sign frames should be attached using through-bolts with lock nuts.
- Fasteners used for attachment to brackets and structures must be fitted with secondary retention.
- Painted or adhesive identification tags are recommended for the identification of piping systems. On hot surfaces, identification tags should be attached using plastic-coated steel bands.

Chapter 17.9: Racks and storage



Best practice

- Racks and storage units must be secured/fastened to permanent structures in an appropriate and durable manner
- Ensure that in all areas is permitted in a controlled manner with respect to the type of goods, duration, storage area and house-keeping
- Storage must not obstruct accessibility or evacuation of the module
- Ensure that the stored materials do not obstruct access to emergency equipment
- Storage racks and storage areas must be designed to ensure that equipment cannot accidentally drop to lower levels
- The heaviest equipment should be stored at the bottom
- If storage at height is necessary, permanently installed equipment containers with lockable, hinged lids shall be used
- On mobile units, temporary storage spaces/racks must be appropriately secured
- Shelves shall be equipped with baffle plates
- Materials must not be stored on top of cabinets/racks

Chapter 17.10: Derrick evacuation equipment



Best practice

- Equipment must be protected from wear and harsh environments.
- Equipment should be stored in a cabinet/locker/bag in order to protect it from UV radiation and weather conditions.
- The riding belt or harness must be attached to the evacuation block or to the guide line where appropriate.
- Safe access to and use of the equipment must be ensured.
- Evacuation blocks, guide lines, attachment points, couplings and shackles are defined as evacuation equipment/fall arrest devices, and must be checked, certified and labelled accordingly.
- Evacuation blocks must be CE-marked.
- Anchor points for suspension must be able to support at least 10kN.
- The equipment must be checked at least every 12 months by a competent person, and shall be labelled with the next inspection date.

Relevant references

Part	Chapter	Page	Reference standards and regulations
1	Purpose and Chapt 2	6 12	NHD regulations: FOR 1987-09-04 no. 856: Regulations concerning the construction of mobile offshore units, and FOR 1987-09-04 no. 859 Regulations concerning protective, environmental, and safety measures on mobile offshore units. AD regulations: Atil Best. no. 529 Regulations concerning workplaces and work premises. HSE regulations from the PSA, with further references
1	Chapt 3	15	Petzl technical guidelines
1	Chapt 5	7	AD regulations: Atil Best no. 221 Regulations concerning technical installations, 555 Regulations concerning the use of equipment, and FOR 2011.12.06 no. 1359 Regulations concerning the construction, design and production of technical installations that are not covered by the regulations concerning machinery EN 13411-3, EN 12385-4, EN 10204-3.1, NS-EN 362
1	Chapt 6	29	SfS recommendation 023, 032 and 033, OLF guidelines 105 and 113 AD regulations: Atil Best. no. 500 Regulations concerning scaffolding, ladders and work on roofs etc., 523 Regulations concerning the construction, design and production of personal protective equipment, 524 Regulations concerning the use of personal protective equipment at the workplace and 555 Regulations concerning the use of equipment. Training plan 0-2.2; Training plan for documented safety training
1	Chapt 8	33	SfS recommendation 001
2	Chapt 13	41	NS-EN 1090-1
2	Chapt 13.3	45	EN-ISO 1234

Part	Chapter	Page	Reference standards and regulations
2	Chapt 13.8	49	ISO 7378
2	Chapt 14.1	54	EN-ISO 1234, NORSOK R-003 and R-005
2	Chapt 14.2	56	NORSOK R-003 and R-005
2	Chapt 14.3	57	AD regulations: Atil Best no. 221, 555 and FOR 2011.12.06 no. 1359 EN 13411-3, EN 12385-4, EN 10204-3.1, NS-EN 362
2	Chapt 14.4	59	NORSOK R-003 and R-005
2	Chapt 15	60	AD regulations: Atil Best. no. 529
2	Chapt 15.1	62	EN-ISO 14122-2, NORSOK S-002 and C-002
2	Chapt 15.2	63	NORSOK D-001, C-002 and S-002
2	Chapt 15.3	65	EN-ISO 14122-3, NORSOK D-001, C-002 and S-002
2	Chapt 15.4	67	EN-ISO 14122-3, NORSOK D-001, C-002 and S-002
2	Chapt 15.5	69	EN-ISO 14122-3, NORSOK D-001, C-002 and S-002
2	Chapt 15.6	71	EN-ISO 14122-1 og-4, NORSOK D-001, C-002 and S-002
2	Chapt 15.7	73	NORSOK C-002
2	Chapt 16	74	NORSOK E-001
2	Chapt 16.1	76	NORSOK S-002 and D-001
2	Chapt 16.2	77	NORSOK S-002 and D-001
2	Chapt 16.3	79	NORSOK D-001
2	Chapt 16.4	81	NORSOK S-002 and D-001
2	Chapt 16.6	87	NORSOK S-002 and D-001
2	Chapt 16.7	89	NORSOK S-002 and D-001
2	Chapt 16.8	91	NORSOK S-002
2	Chapt 17.1	95	SfS recommendation 001

Part	Chapter	Page	Reference standards and regulations
2	Chapt 17.4	101	NORSOK S-001 and S-002 NHD regulations: FOR 1987-09-04 no. 859 Regulations concerning protective, environmental, and safety measures on mobile offshore units
2	Chapt 17.5	103	NORSOK R-003, R-005 and SfS recommendation 014
2	Chapt 17.6	105	NORSOK R-003
2	Chapt 17.7	107	API spec -7K and API RP-7L
2	Chapt 17.8	109	AD regulations: Atil Best. no. 526 § 10 and § 11 Regulations concerning safety signage and signalling at the workplace NORSOK D-001 and C-002
2	Chapt 17.9	111	NORSOK S-001 and S-002
2	Chapt 17.10	113	AD regulations: Best. no. 555 NS-EN 341, NS-EN 361, NS-EN 362, NS-EN 365, NS-EN 795 and NS-EN 813

For an updated list of references, please visit:
<http://www.samarbeidforsikkerhet.no>
Ref. Recommendation no. 24

**If you have questions or comments regarding
the content of this handbook, please contact:
post@sfs.no**

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If this wrench weighs 1 kg and falls 2 metres,
this constitutes a fall energy of 19.6 Joules.

Ref.: Pages 14 and 15.